STAR near Term Upgrade & RD plans

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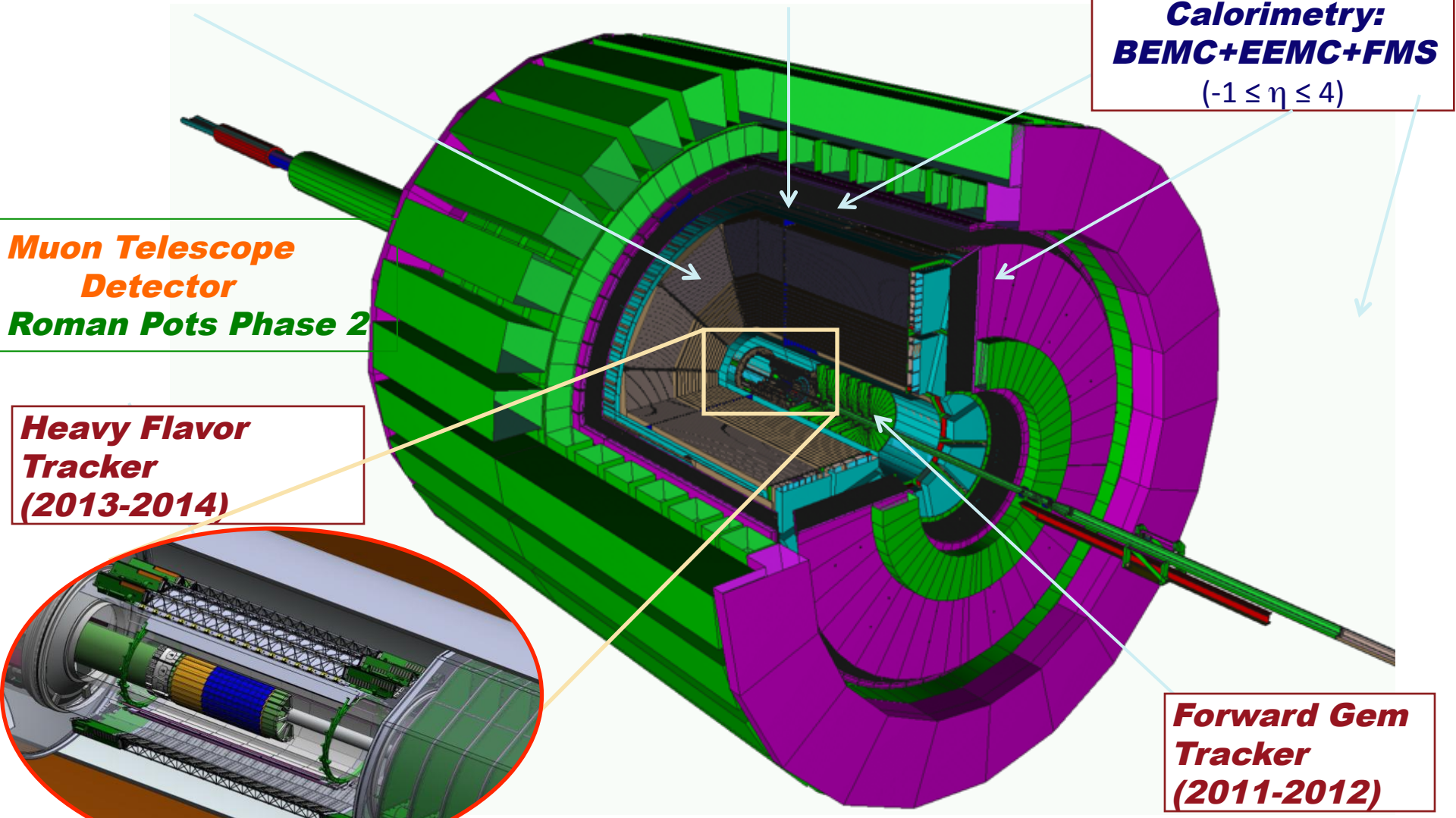
BNL

Introduction

- STAR prepared a decadal plan earlier this year. The plan is a working document covering the period 2011-2018 and ideas for transitions to eRHIC phase1.see http://www.bnl.gov/npp/docs/STAR_Decadal_Plan_Final[1].pdf
- Here we will discuss the near and mid-term, while eSTAR ideas will be presented later today.

STAR: A Typical Collider Detector



Mid-Rapidity Physics Coverage is almost complete !!

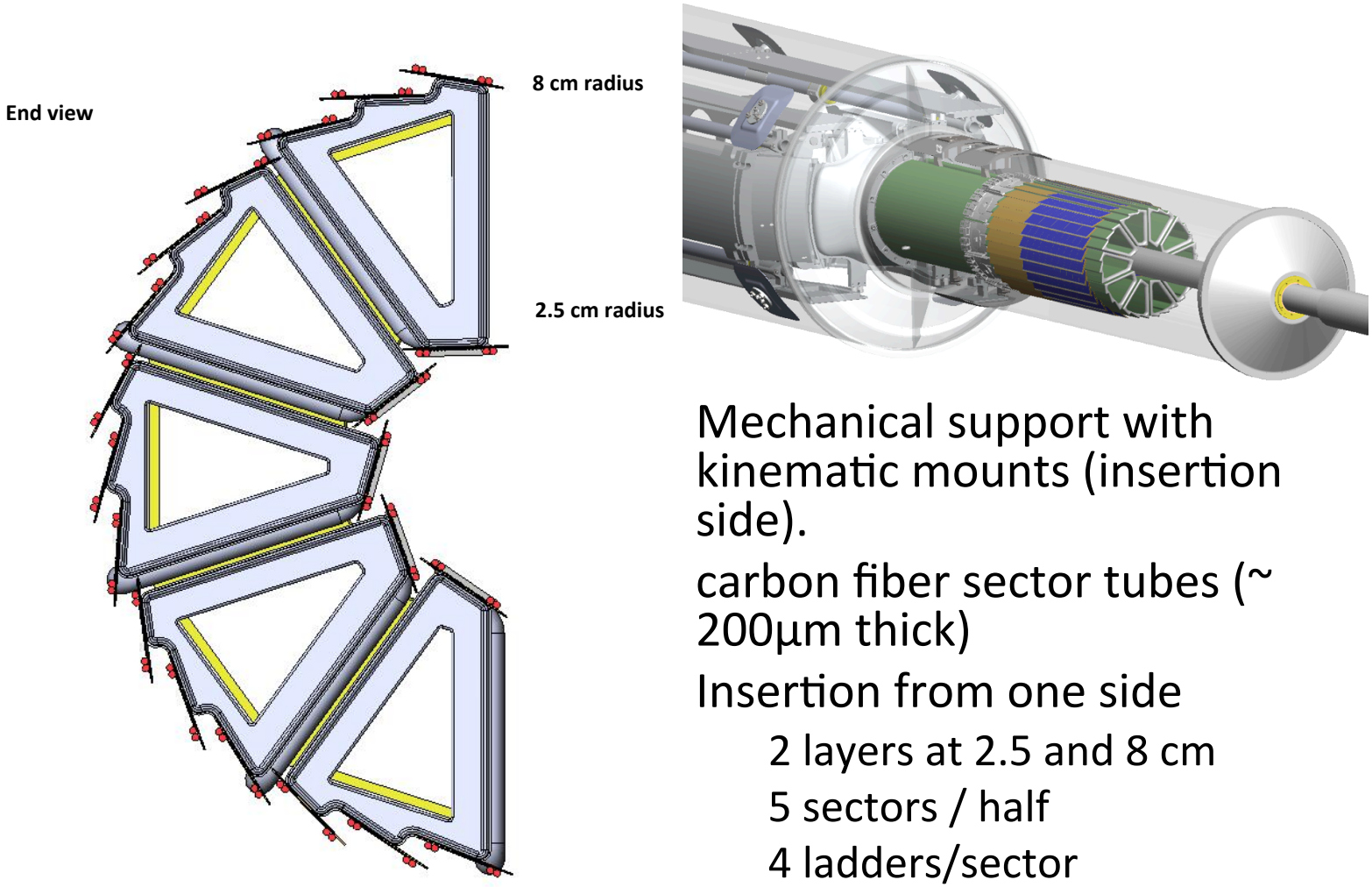
Near Term

- Forward GEM Tracker
  - 60% complete this year. 3 layer GEM with APV chip readout
- Heavy Flavor Tracker
  - Thin pixel CMOS in collaboration with IPHC.
- Muon Telescope Detector
  - Approved project in construction phase.
  - Base on long MRPC technology in coll. with China and India, and electronics developed for STAR TOF

CMOS technology

- Will be used in HFT. Much experience within project.
- Plans for using in EIC (LDRD, Elke A.)
- Common interest and exchange of status, ideas was done at St.Odile workshop in September. Could be pursued as common interest.

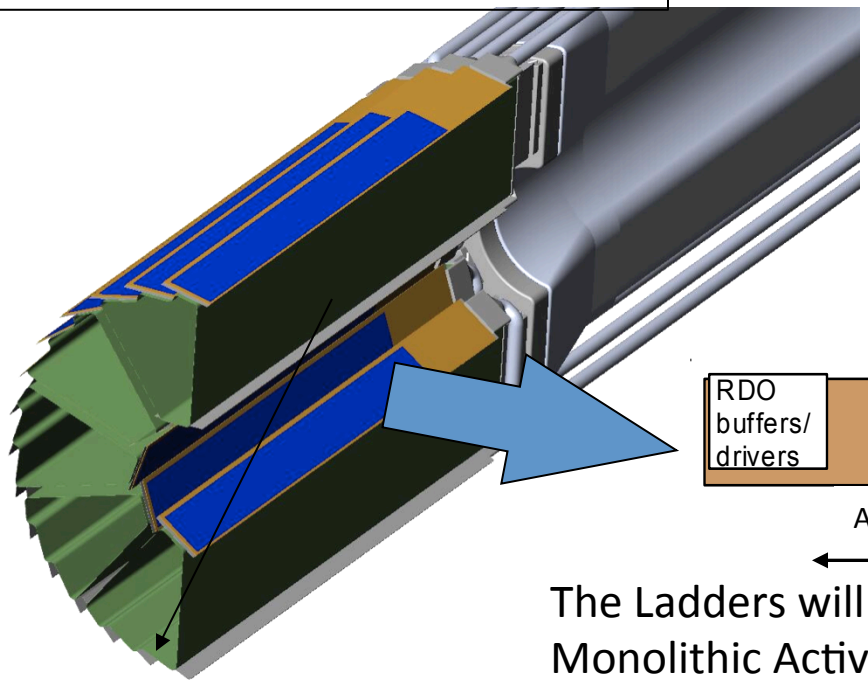
Pixel Detector (PXL)



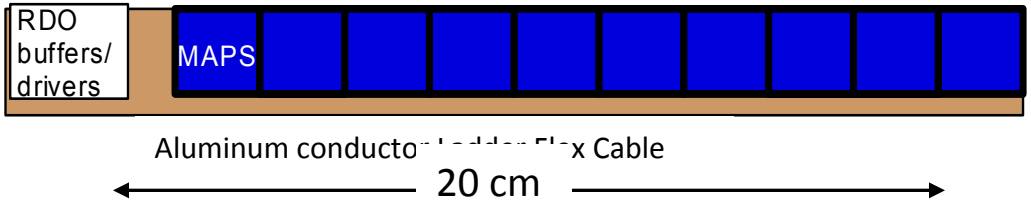
- Mechanical support with kinematic mounts (insertion side).
- carbon fiber sector tubes (~ 200µm thick)
- Insertion from one side
  - 2 layers at 2.5 and 8 cm
  - 5 sectors / half
  - 4 ladders/sector

PXL Detector Design

carbon fibre sector tubes (~ 200µm thick)



Ladder with 10 MAPS sensors (~ 2×2 cm each)



The Ladders will be instrumented with Monolithic Active Pixel Sensors thinned down to 50 micron Si

The IPHC designed sensor will use a 400 ohm*cm epitaxial layer as the default configuration.

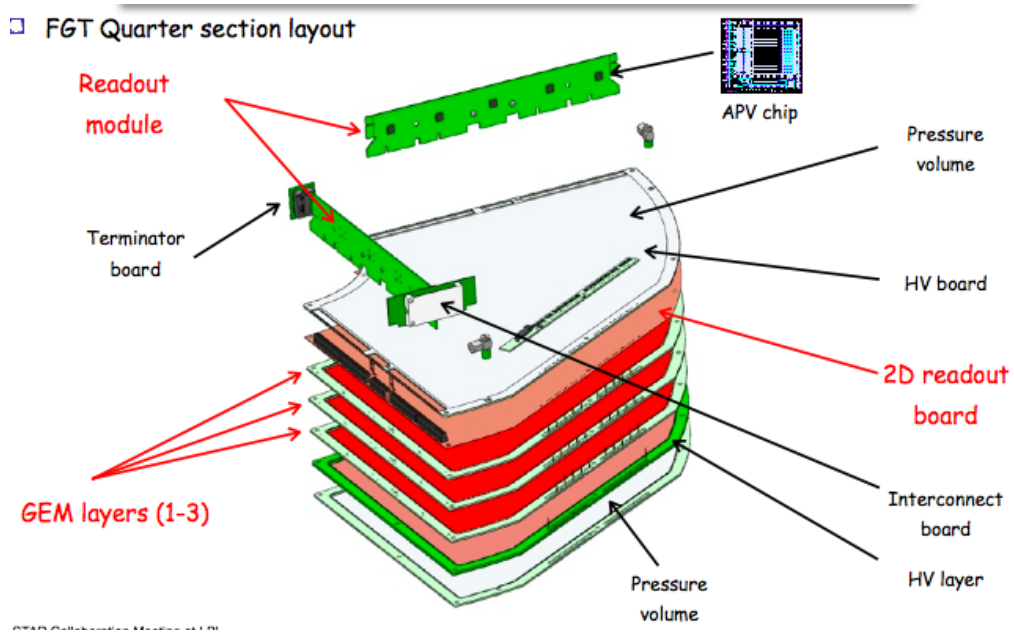
Air cooled .

GEM

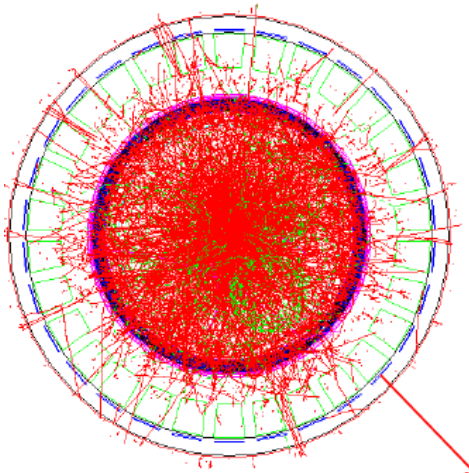
- Expertise exists within STAR on GEM technology . Also planned for upgrades possible in the longer term, both for a pA,pp and eA program at RHIC.
- We see a need for new readout technology, the current supply of APV chips will run out (possible has).

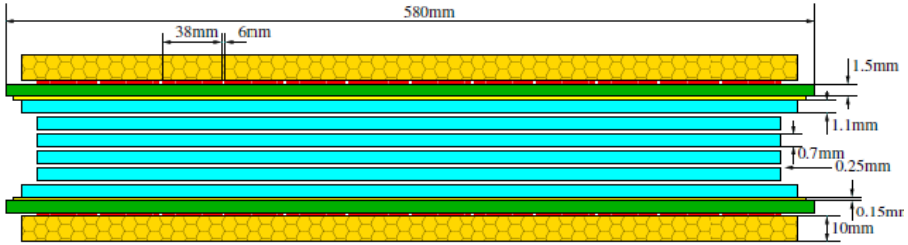
GEM technology

- The forward GEM tracker was installed (60%) this year.
- Expertise on foils, mounting structures, and readout. (MIT, Yale, Indiana).

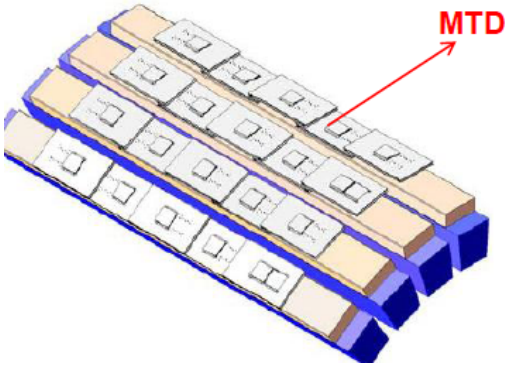


Muon Telescope Detector





MTD



Multi-gap Resistive Plate Chamber (MRPC): gas detector, avalanche mode

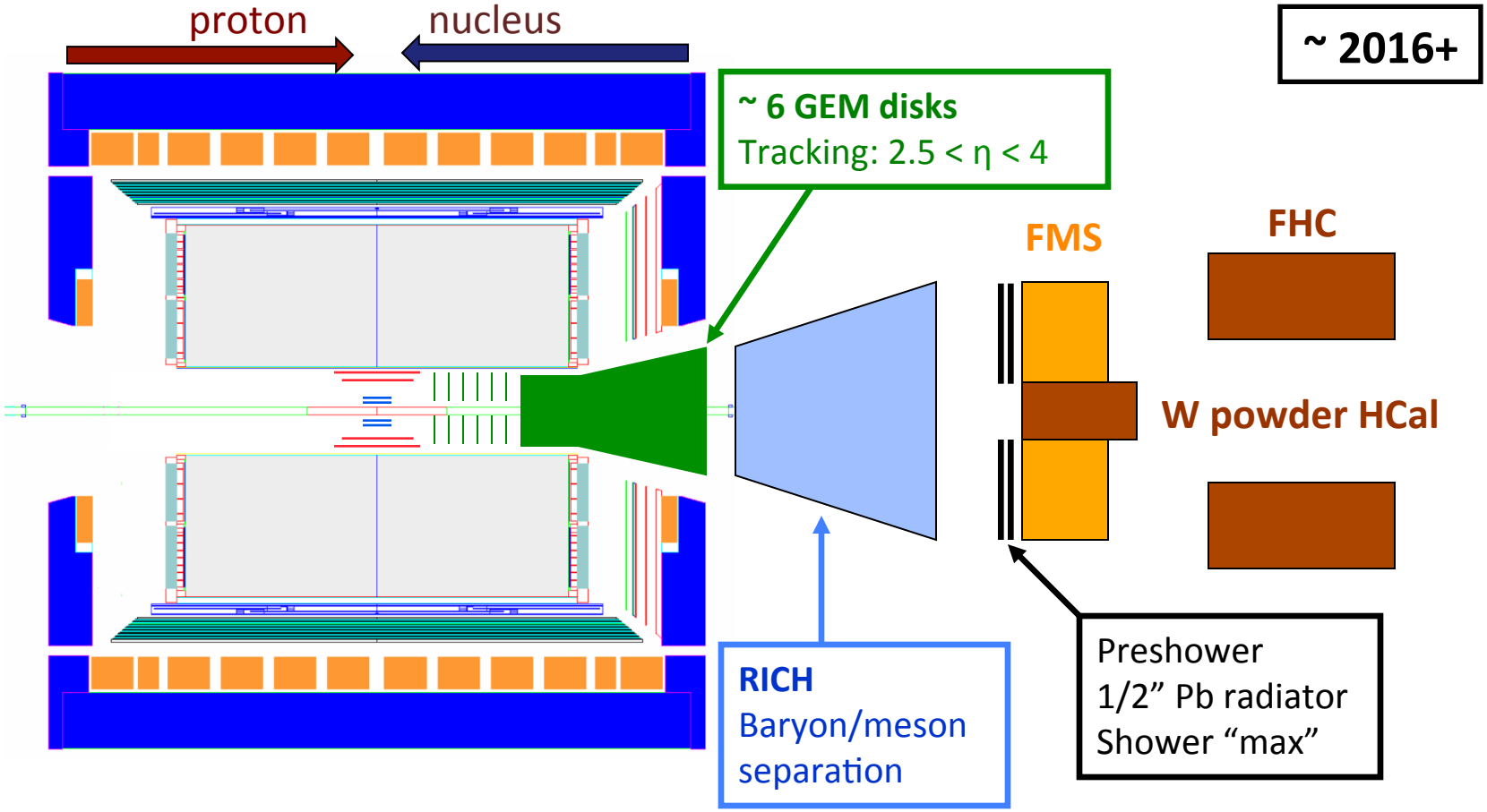
A detector with long-MRPCs covers the whole iron bars and leave the gaps in-between uncovered. Acceptance: 45% at $|\eta|<0.5$

118 modules, 1416 readout strips, 2832 readout channels

Long-MRPC detector technology, electronics same as used in STAR-TOF

Possible extensions: High-rate/radiation hard MRPC TOF: USTC/Tsinghua have been developing that for CBM, we are in the process of evaluating our requirements for forward direction (not so forward -2<eta<-1) [eSTAR]

STAR forward instrumentation upgrade



- **Forward instrumentation optimized for p+A and transverse spin physics**
  - **Charged-particle tracking**
  - ***e/h* and γ/π^0 discrimination**
  - **Baryon/meson separation**

Forward Upgrades

- Calorimeters
  - W-cal, FAIR may be interested in this,
  - crystal calorimeter (BSO) UCLA,TAMU,PSU
- For pp and pA under consideration are:
  - Cherenkov detector. Inspired by Hermes-BRAHMS
  - Forward tracking (2.5<eta<3) GEM

Triggering Components

- Trigger is another issue since the clock is changed eSTAR; major changes in triggers are required (DSM-II may do the job), but other changes less trivial.
  This may be worthwhile pursuing the so-called trigger less scheme, adapted by CBM (similar to the idea of TOF HPTDC)

Summary

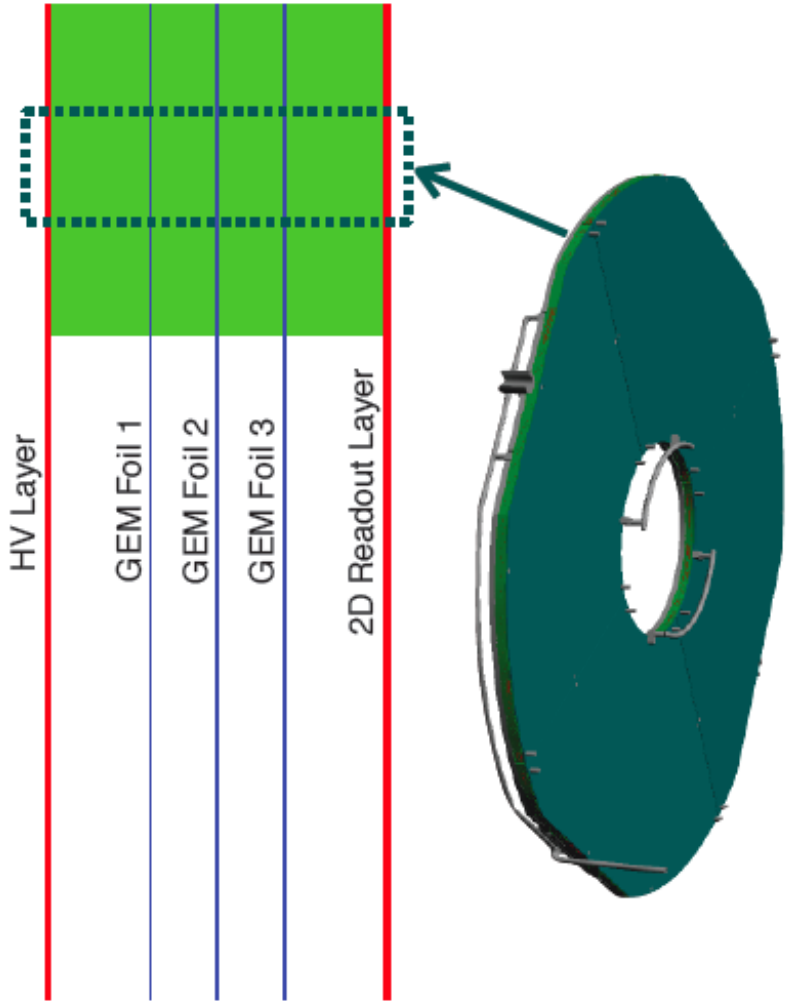
- STAR is planning for the next decade
- There may be areas of common interest that should be discussed

Backup Info

- A few details on GEM (B.Surrow Star collaboration meeting Nov. 17)

FGT Technical realization / Layout

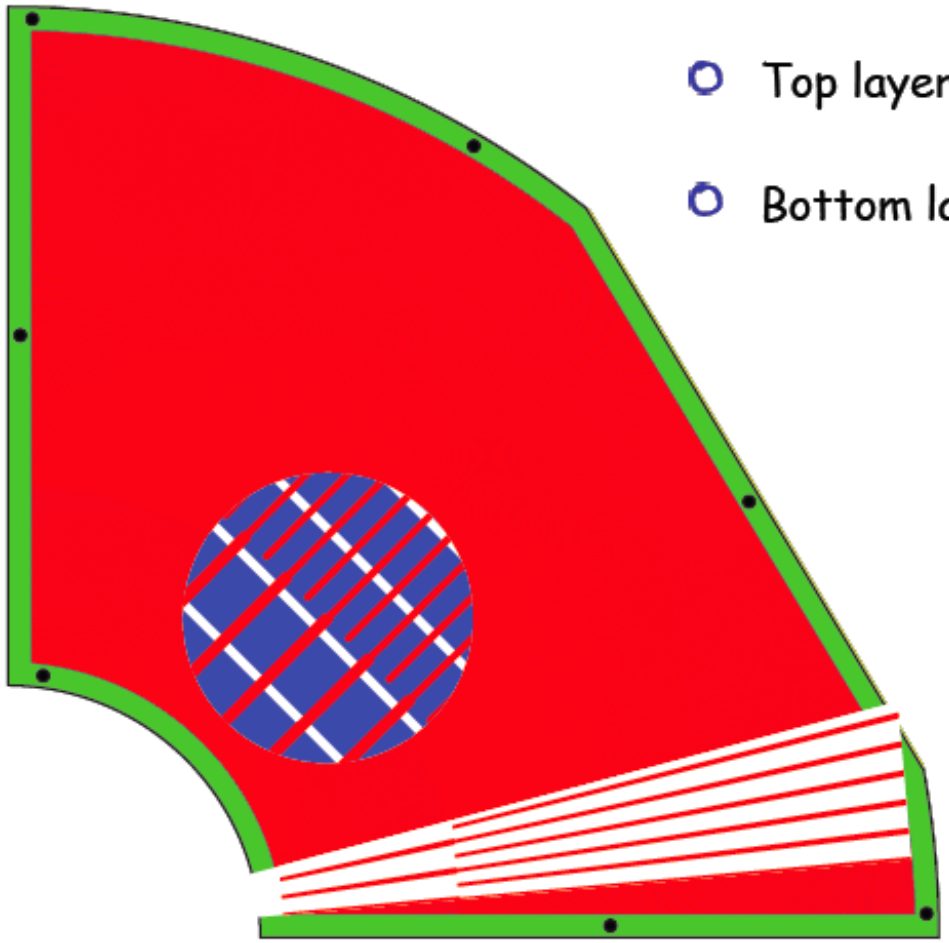
- Triple-GEM: Quarter section / Disk design (2)



Component	Material	Radiation Length [%]
Support plate	5 mm Nomex	0.040
	2x250 μm FR4	0.257
HV layer	5 μm Cu	0.035
	50 μm Kapton	0.017
GEM foils	6x5 μm Cu (70%)	0.147
	3x50 μm Kapton (70%)	0.036
Readout	5 μm Cu (20%)	0.007
	50 μm Kapton (20%)	0.003
	5 μm Cu (88%)	0.031
	50 μm Kapton	0.017
	5 μm Cu (10%)	0.004
	5 μm Cu (10%)	0.004
Drift gas	10 mm CO_2 (30%)	0.002
	10 mm Ar (70%)	0.006
Total		0.606

FGT Technical realization / Layout

- Triple-GEM: Quarter section design



- 2D readout board
- Top layer: Φ-readout layer
- Bottom layer: R-readout layer